

## Reinstatement of the northern Australian species *Cleome linophylla* (O. Schwarz) Pax & K.Hoffm. (Capparaceae), and neotypification of its basionym, *Triandrophora linophylla* O.Schwarz

Philip Short

Northern Territory Herbarium, PO Box 496, Palmerston, Northern Territory 0831, Australia

### Abstract

*Cleome linophylla* (O.Schwarz) Pax & K.Hoffm. is reinstated as a distinct species, a neotype of its basionym, *Triandrophora linophylla* O.Schwarz is chosen, and a description and illustration are presented. The authorship of the taxonomic synonym *C. tetrandra* var. *simplicifolia* Hewson is discussed.

### Introduction

The genus *Cleome* L., commonly placed in the family Capparaceae (e.g. Cronquist 1981, Hewson 1982) but perhaps best referred to the Brassicaceae or a separate Cleomaceae (e.g. Judd *et al.* 1999, Hall *et al.* 2002), is widespread in subtropical and pantropical regions of the world, with more than 150 species being recognised. Hewson (1982), recognising ten species, produced the most recent account of the genus in Australia. However, following examination of herbarium specimens and field observations of *Cleome* it has become evident that her treatment does not account for many taxa found in northern Australia. Preliminary sorting of specimens in the Northern Territory Herbarium (DNA) alone suggests that perhaps ten unnamed taxa occur in the N.T. Many of these taxa are currently placed in polymorphic *C. tetrandra* DC.

Hewson, undoubtedly handicapped by not having adequate, well-labelled specimens and by not seeing specimens in the field, recognised three infraspecific taxa within *C. tetrandra*, i.e. var. *tetrandra*, var. *pentata* Hewson and a taxon she attributed to Ferdinand Mueller, var. *simplicifolia* F.Muell. These were recognised on the basis of just a few characters – the presence or absence of compound leaves, the number of leaflets (mostly 3-foliolate or mostly 4- and 5-foliolate), and the number of stamens (3 only, 4 only, or 4–7). Field observations show that other features, particularly the arrangement (not just the number) of stamens and the orientation and colour of the petals, also allow for the discrimination of entities which are, following Hewson, referable to *C. tetrandra*. Furthermore, additional collections of mature plants show that seed morphology – including ornamentation of the testa and the size and structure of the elaiosome – is also important in delimitating taxa currently referred to *C. tetrandra*.

Further work is required before some of these taxa can be formally described and named and the subject matter for this note is the taxon referred to by Hewson as *C. tetrandra* var. *simplicifolia* F.Muell. It is accepted here as a distinct species to which the name *C. linophylla* (O.Schwarz) Pax & K.Hoffmann applies. A description of the species is provided, a neotype is chosen, and the authorship of the taxonomic synonym, *C. tetrandra* var. *simplicifolia*, is discussed.

### Taxonomy

*Cleome linophylla* (O.Schwarz) Pax & K.Hoffm., *Nat. Pflanzenfam.* 2<sup>nd</sup> ed., 17b: 212 (1936). *Triandrophora linophylla* O.Schwarz, *Rep. Spec. Nov. Reg. Veg.* 24: 85 (1927), basionym. Type citation: "Port Darwin, Rapid Creek, open forest (Bleeser no. 641).", not found. Neotype (here chosen): open, disturbed woodland on laterite adjacent to Leaning Tree Lagoon turn-off from Arnhem Highway, Northern Territory, 7 Jan. 2002, P.S. Short 5138 (DNA 172234). Isoneotypes: K, MEL.

*Cleome tetrandra* var. *simplicifolia* Hewson, *Fl. Australia* 8: 230 (1982), see note below. Type citation: "Darwin, Schultz; holo: MEL." Holotype: Port Darwin, [Frederick] Schultz 87, [1869 or 1870], (MEL 590948), see note below.

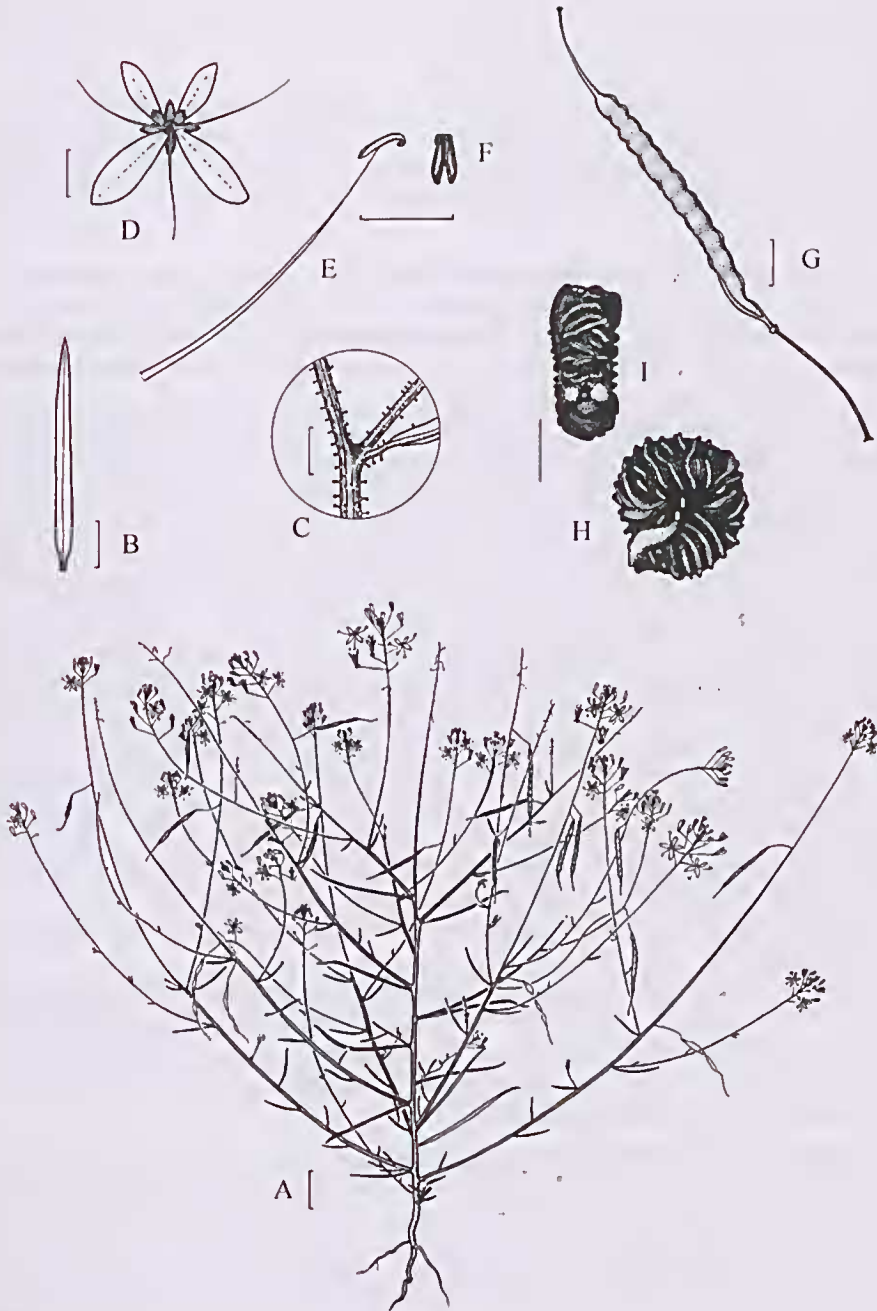
Annual herb with ascending to erect branches to c. 30 cm long, smallest plants erect and unbranched, stem and branches with a scattered but prominent indumentum of stalked, rigid glandular hairs. Leaves simple, linear, 2–40 mm long, 0.3–1.8 mm wide, shortly petiolate or the upper leaves sessile, with margins entire, apically weakly mucronate; petiole less than c. 1.3 mm long. Flowers c. 5–14 in a raceme. Sepals ovate to lanceolate, 0.8–1.3 mm long, 0.2–0.45 mm wide, mostly pale green, usually with a few glandular hairs. Petals oblanceolate and with no obvious claw, 3.2–4.9 mm long, with 2 petals held erect and 2 pointing down; upper petals shorter than the lower, at anthesis mainly yellow but each with an orange or reddish band towards the base and tending to be darker yellow beneath the band; lower petals at anthesis yellow throughout; all petals when in bud with dark pinkish or purplish apex, all mature petals commonly becoming white or pinkish- or purplish-white on drying and the band on the upper petals often not evident. Stamens usually 3, with two lateral stamens in the same plane and one curving down, sometimes with an additional upper stamen; filaments equal or somewhat unequal, 2.8–5.4 mm long, the lower  $\frac{1}{3}$ – $\frac{1}{2}$  of the filament yellowish-green, the upper  $\frac{1}{2}$ – $\frac{2}{3}$  of the filament reddish; anthers grey. Gynophore absent. Ovary sessile, glabrous, with a green c. 0.3 mm long fleshy protuberance (nectary?) between its base and the base of the upper petals. Capsules on glabrous pedicels 6–13 mm long, linear, subcylindrical, 13–19 mm long, c. 1.5 mm diam., held at less than 90° to the axis, with faint longitudinal striations, glabrous, with a beak 1.5–4 mm long. Seeds c. 7 per fruit, comma-shaped or suborbicular, 1.15–1.3 mm across longest axis, 0.9–1.2 mm across shortest axis, dark brown or orange-brown, cross-ribs distinct, concentric rings absent or very faint; elaiosomes present, small, one on each side of the funicle. Flowering & fruiting: Jan.–Feb. Fig. 1.

*Distribution:* Endemic to the Top End of the Northern Territory, Australia, ranging from the vicinity of Darwin east to Oenpelli and extending south to about Mataranka.

*Habitat:* *Cleome linophylla* grows on laterite gravel in open *Eucalyptus* and *Terminalia* woodland and is often noted on disturbed road verges, a fact suggesting that it may now be more widespread than it was prior to roadbuilding in the Top End.

*Specific status:* *Cleome tetrandra* DC. was described from a specimen in the Banks Herbarium, de Candolle noting that flowers have four stamens and that the leaves are 3-foliolate. *Cleome linophylla* is readily distinguished from typical *C. tetrandra* by having usually three, not four, stamens and by its simple leaves.

Petal arrangement was not noted by de Candolle but it is evident that *C. linophylla* is one of several taxa generally referred to the *C. tetrandra* complex with the four petals arranged in a cross, i.e. having two erect petals and two downward-pointing petals; other taxa in the complex have flowers with four erect petals. Of the taxa with a cross-



**Figure 1.** *Cleome linophylla*: A, habit; B, leaf; C, branchlets and leaf base showing stalked glandular hairs; D, illustration of flower drawn in the field, note that anthers have fallen; E, stamen; F, anther; G, fruit; H, side view of mature seed; I, mature seed showing elaiosomes on either side of the funicle. (A–D, G, H, from neotype. *Short 5138*; E, F, *Short 5136*). Scale bars: A = 1 cm, B = 5 mm, C, D, G = 2 mm, E, F, H, I = 1 mm.

shaped arrangement of petals, *C. linophylla* is the only one with simple leaves and commonly 3 stamens per flower. It is also one of only several taxa in the complex that produce a seed with two distinct elaiosomes.

*Conservation Status:* *Cleome linophylla* is not represented by many collections but field work indicates that numerous individuals may be present in populations. This fact, combined with its widespread habitat and liking for disturbed sites, suggests that following the IUCN Red List Categories Version 3.1 the species is one of "Least Concern".

*Neotypification:* The name *Triandrophora linophylla* was one of 43 new specific names applied by Schwarz (1927) to specimens collected in the Darwin region by F. A. K. Bleeser. McKee (1963) noted that the type specimens examined by Schwarz were incorporated in the Berlin Herbarium (B) and that all "seem to have been destroyed" (McKee 1963, p. 233) during World War II and that there was no record of any duplicates of Bleeser's specimens being distributed from B. He also noted that Bleeser himself kept, and may have distributed, duplicate specimens but that "Inquiries at the Arnold Arboretum, Kew, and several Australian herbaria ... failed to locate any substantial number of Bleeser duplicates" (McKee 1963, p. 233). However, McKee did list isotype specimens relevant to nine names established by Schwartz and which were incorporated in NSW in 1927. Subsequently, Willis (1966) noted that eight isotypes relevant to Schwartz's work had been received from Bleeser and incorporated in MEL in 1929, with four of these not represented in NSW. However, none of the specimens recorded by these authors to be in NSW and MEL was of *T. linophylla*. Furthermore, although Bleeser apparently retained a personal set of collections at his private residence in Darwin, Willis recorded that it was destroyed after Bleeser and his wife were evacuated from their Darwin home following the first Japanese bombing in February 1942. Bleeser died that same year in Adelaide, "heartbroken by the news that his carefully annotated specimens, zoological and botanical books and indexed photographic plates, the result of fifty years work, had been thrown out of his home by looters and trampled and destroyed in a day" (Lockwood 1992, p. 109).

Enquiries have reconfirmed the absence of any duplicate specimens of *Bleeser 641* at K, MEL and NSW.

Thanks to the detailed original description, and the apparent absence of any other taxon in the Darwin region with simple leaves and mostly three anthers, there can be no doubt as to the application of the name *T. linophylla*. Furthermore, there is no reason to believe that any original material is still extant. Accordingly, a neotype specimen, *Short 5138*, for the name *T. linophylla* has been chosen.

*Authorship of C. tetrandra* var. *simplicifolia*: Hewson (1982) recognised three varieties of *C. tetrandra* DC.: var. *tetrandra*, var. *simplicifolia* F.Muell. and var. *pentata* Hewson. When recognising the name var. *simplicifolia* F.Muell. she recorded that the holotype is in the National Herbarium of Victoria (MEL) and made a direct reference to the purported original publication by Mueller (1869). Chapman (1991), although including var. *simplicifolia* F.Muell. as a name in the *Australian Plant Name Index*, queried its status by noting "valid?" and by enclosing the entry in square brackets. However, it cannot be that the name was invalidly published by Mueller as he never proposed one. In following a note on *Helicteres spicata* with a list of additional species collected by Schultz from the Darwin region Mueller was doing nothing more than noting that Schultz's collection included a variant of *C. tetrandra* with simple leaves and three anthers, i.e. he recorded "...*Clematis glycinoides* Cand., *Cleome viscosa* L.,

*Cleome tetrandra* Banks var. *simplicifolia* triandra, *Polygala orbicularis* ...” (Mueller 1869, p. 40).

Although Mueller did not supply a name for the taxon he can be said to have provided a diagnosis to which Hewson made direct reference, while she also provided the name and specified the holotype. Article 41.3 of the *ICBN* (Greuter *et al.* 2002) allows valid publication by “reference to a previously and effectively published description or diagnosis of a species or infraspecific taxon” and with Mueller’s diagnosis being in Latin the requirement of Art. 36, that to be validly published on or after 1 January 1935 the name of a new taxon need only be accompanied by “reference to a previously and effectively published Latin description or diagnosis”, is also met. Similarly, the requirements of Art. 37.1, to indicate the type of the name, are met. It is therefore concluded that Hewson, unintentional though it was, validly published the name var. *simplicifolia*.

*Type specimen of C. tetrandra* var. *simplicifolia*: As noted in the original description the type specimen of the name var. *simplicifolia* was simply attributed to “Schultz”. Frederick Schultz and his son Alfred were members of George Goyder’s survey party of Darwin (c.g. Lockwood 1968). Undoubtedly both collected specimens but in both unpublished and published lists of specimens viewed by me all are simply attributed to Frederick and that procedure is followed here. As to the time of collection it is known that Goyder’s party landed in Darwin in late December 1868 and that Frederick Schultz was still resident in Darwin in February 1870 and seemingly to at least late May (Cavenagh 1870). I have also only noted this species flowering in January and February. Thus, available facts indicate that the type specimen was collected in the first couple of months of either 1869 or 1870.

The specimen consists of a single, very mature plant which is almost devoid of leaves and to which only remnants of fruit are attached. The leaves that remain, including some from near the base of the plant, are always unifoliate. Several flowers are held in an accompanying packet and match Mueller’s description in that there are only three stamens per flower. The packet also contains several fruit, or parts of fruit, which contain very immature seed. Due to their immaturity it is not clear whether the seed would have developed one or two elaiosomes. Despite it being a rather poor specimen, given my knowledge of the variation in the *C. tetrandra* complex in the Darwin region, I do not doubt that the name *C. tetrandra* var. *simplicifolia* is a synonym of *C. linophylla*, and here treat it as such.

Two handwritten labels accompany the holotype specimen at MEL. One is on lined paper and I do not know whether it is an original label. It simply reads “*Cleome tetrandra* Banks/ Port Darwin/ Schultz”. The other label has the printed heading “Phytologic Muscum of Melbourne” and the handwritten notation “*Cleome*/ Port Darwin/ 87/ Schultz”. It is perhaps reasonable to assume that the number 87 is Schultz’s specimen number. However, if it is his number, then it is not unique to that collection. Many of Schultz’s specimens were sent by Richard Schomburgk to Kew for identification and the K library holds unpublished lists of instalments (or series) of the specimens which were received. There is no duplication of numbers on these lists and the list of the first instalment of specimens, communicated by Schomburgk in October 1869, shows *Schultz 87* to be a specimen of a legume. However, aware that labels can be incorrectly attributed to specimens and, from the unpublished lists, that *Schultz 213* and *Schultz 286* held at K were determined as *C. tetrandra*, I arranged to view electronic images of both specimens to see if either matches the holotype at MEL. Indeed, that this needed to be done has since been verified by one of the referees who kindly noted that “The impression I have from seeing specimens from a number of

collectors, sent by Schomburgk to Kew, is that the numbers are not those of the collectors but may have been added by Schomburgk before despatch.”

Having examined the specimens it is clear that *Schultz 213* (K215249), although belonging to the *C. tetraudra* complex, has 3-fid, and perhaps even some 5-fid leaves and thus is not *C. linophylla*. The other specimen, *Schultz 286* (K215250) does look somewhat like the type specimen of var. *simplicifolia* at MEL, but unfortunately it is not clear from the image if one of the few leaves on the righthand side of the specimen is single or 3-foliolate. Thus, I cannot definitely exclude the possibility that an isotype of var. *simplicifolia* exists at K but equally there is no compelling evidence that this is the case.

In the above discussion I have spelled the collector's surname as Schultz. I have opted to follow this spelling as it is that used on all specimens referred to herein, on the unpublished lists at K, on a published report of his specimens (Anon. 1870), and in the original publication of the name var. *simplicifolia*. However, the spellings “Schulze” (e.g. letter reproduced in Home 2002, p. 479) and especially “Schultze” (c.g. Cavenagh 1870, Lockwood 1968, Payne 1992, De La Rue 2004), all clearly referring to the same person, are also encountered in government documents of that time as well as in recent accounts of the early exploration and history of Darwin.

*Specimens examined:* Thorak Reserve, Shoal Bay, 7 Feb. 1979, *M.H. Andrew 327* (DNA); Ranger Uranium lease, Kakadu, 20 Mar. 1991, *K. Brennan 1198* (DNA); East Alligator River, 16 Feb. 1973, *C.R. Dunlop 3248* (DNA); c. 8 miles NE of Oenpelli Mission, 17 Feb. 1973, *M. Lazarides 7750* (DNA); 23 miles S of Darwin, 22 Feb. 1972, *J. Must 942* (DNA); Cannon Hill airstrip, 30 Jan. 1973, *P. Martensz AE610* (DNA); Koolpinyah Station, Howard River, on laterite, 14 Jan. 1997, *C. Michell 318* (DNA); 5 miles W of Stuart Hwy along road to Mandorah, 11 Jan. 1971, *J. Must 663* (DNA); Nitmiluk National Park, 19 Apr. 2001, *J.A. Risler 1621* (DNA); 8.6 km E of Corroboree Park, 7 Jan. 2002, *P.S. Short 5136* (DNA); adjacent to Leaning Tree Lagoon turn-off from Arnhem Highway, 7 Jan. 2002, *P.S. Short 5138* (DNA, neotype; K, MEL, isoneotypes); intersection of Central Arnhem Road and Stuart Highway, 11 Feb. 2004, *P.S. Short 5161* (DNA); 11.6 km S of Central Arnhem Road turnoff along Stuart Hwy, 12 Feb. 2004, *P.S. Short 5168* (DNA); 5 km NE of Howard River bridge, 17 Feb. 2005, *P.S. Short 5375* (DNA).

### Acknowledgements

Monika Osterkamp Madsen provided the excellent illustration of *C. linophylla*. I also thank Jim Ross for kindly arranging the prompt supply of the holotype specimen of *C. tetraudra* var. *simplicifolia* from MEL and Annette Wilson (Australian Botanical Liaison Officer 2004/05) who organised the supply of jpeg images of specimens of *C. tetraudra* s. lat. held at K. Jim Ross, Barry Conn and Annette Wilson also kindly confirmed that MEL, NSW and K respectively do not hold specimens of *Bleeser 641*.

Kathy De La Rue very kindly gave me access to her copies of early *South Australian Parliamentary Papers* and Goyder's diary, helping me to investigate the activities of Frederick Schultz.

I also thank both referees for comments on the original manuscript, particularly in reference to the Schultz collections and Schomburgk's possible numbering of specimens.

### References

- Anon. (1870). *Third list of plants and seeds, collected by Mr. Fred. Schultz, botanist to the Northern Territory Expedition*. (Govt Printer: Adelaide).

- Cavenagh, W. (1870). Instructions to Government Resident, Northern Territory. *South Australian Parliamentary Papers* 1870–71, nos. 25 & 26.
- Chapman, A. D. (1991). *Australian plant name index, A–C*. (Australian Government Publishing Service: Canberra). p. 746.
- Cronquist, A. (1981). *An integrated system of classification of flowering plants*. (Columbia University Press: New York).
- De La Rue, K. (2004). *The evolution of Darwin, 1869–1911: a history of the Northern Territory's capital city during the years of South Australian administration*. (Charles Darwin University Press: Darwin).
- Greuter, W., McNeill, J., Barrie, F. R., Burdet, H. M., Demoulin, V., Filgueiras, T. S., Nicolson, D. H., Silva, P. C., Skog, J. E., Treharne, P., Turland, N. J. & Hawksworth, D. L. (2002). *International Code of Botanical Nomenclature (St Louis Code)*. (Koeltz Scientific Books: Königstein, Germany).
- Hall, J. C., Sytsma, K. J. & Iltis, H. H. (2002). Phylogeny of Capparaceae and Brassicaceae based on chloroplast sequence data. *American Journal of Botany* 89: 1826–1842.
- Hewson, H. J. (1982). *Cleome* L. *Flora of Australia* 8: 223–231.
- Home, R. W., Lucas, A. M., Moroske, S., Sinkora, D. M. & Voigt, J. H. (2002). *Regards yours. Selected correspondence of Ferdinand von Mueller*. (Peter Lang: Bern). Vol. 2.
- Judd, W. S., Campbell, C. S., Kellogg, E. A. & Stevens, P. F. (1999). *Plant systematics. A phylogenetic approach*. (Sinauer Associates Inc.: Sunderland, Mass., U.S.A.)
- Lockwood, D. (1968). *The front door: Darwin 1869–1969*. (Rigby: Adelaide).
- Lockwood, D. (1992). *Australia's Pearl Harbour*. (Penguin Books Australia: Melbourne). (Revised edn, first publ. by Cassell Australia Ltd, 1966).
- McKee, H. S. (1963). The Bleeser botanical collection from Northern Australia. *Contributions from the New South Wales National Herbarium* 3 (4): 233–234.
- Mueller, F. (1869). *Helicteres spicata* [and following notes]. *Fragmenta Phytographiae Australiae* 7: 39–40. [Fascicle 52, published in October.]
- Payne, P. (1992). *Dr Richard Schomburgk and Adelaide Botanic Garden 1865–1891*. (PhD Thesis, Faculty of Arts, University of Adelaide).
- Schwarz, O. (1927). Plantae novae vel minus cognitae Australiae tropicae. *Repertorium specierum novarum regni vegetabilis* 24 (1927/1928): 80–109.
- Willis, J. H. (1966). Bleeser specimens in the National Herbarium of Victoria, with some notes on their collector. *Contributions from the New South Wales National Herbarium* 4(1): 9–11.